

(1) Probability of MES channel selection

Assuming that the maximum number of available channels for Non-GSO MSS system is M , and the maximum number of simultaneous operable channels for one Non-GSO-Satellite is m , the probability that one channel be selected by MES, which would cause interference to the MS system of using the same channel, η_c , is given by the following equation:

$$\eta_c = \frac{m}{M} \times \gamma \quad (22)$$

where, γ is the correction factor for the probability of MES channel selection due to the operation of Dynamic Channel Activity Assignment System (DCAAS). The employment of DCAAS system can avoid the channel which is being used by the existing system, however, the set of channels selected by DCAAS would be dependent on the activity of M channels in the existing system.

(2) Percentage of time that Non-GSO system is in use

The percentage of time that Non-GSO MSS system is in use, is assumed to be η_L .

(3) Percentage of time that the existing system is in the communications mode

The percentage of time that the existing system is in the communications mode, is assumed to be η_m . In practice, the existing system is usually operated in the one way mode by using the press talk type terminal. In this case, the percentage of time for each direction of channel in communicating is $1/2$ of η_m .

(4) Probability that DCAAS fails to detect the active channel used by existing system

The DCAAS on board satellite has a capability to detect all channels being used by existing system, however, there might be blockage in between LMS and satellite that disables the DCAAS to detect the signals transmitted from LMS. Taking into this fact, the probability that DCAAS fails to detect the active channel being used by existing system is assumed to be η_D .

(5) Satellite Visibility factor in the case of multiple Gateway earth station

If more than one gateway earth station are installed in an area, the number of satellites increases that MESs can access simultaneously, and the interference probability to the existing system also increases. η_G is assumed as the ratio of available number of channels with multiple gateway earth stations to single gateway earth station.

(6) Percentage of time that the existing system is in the waiting mode

The percentage of time that the existing system is in the waiting mode, is assumed to be η_w . From the fact that the existing system is either in the communication mode or in the waiting mode, the following relationship between η_w and η_m can be satisfied.

$$\eta_w = 1 - \eta_m \quad (23)$$

(7) Number of interfering signals within the occupied bandwidth of the MS carrier

If the occupied bandwidth for Non-GSO MSS carrier is narrower than that for MS carrier, multiple interfering carrier would be observed in the wanted MS carrier occupied bandwidth. Under the assumption described above, the additional interference power level given by the following equation might be considered in the calculation of C/I .

$$I = 10 \log(B_w/B_i) \quad (24)$$

where, B_w and B_i are the occupied bandwidth for MS carrier and MES carrier, respectively. Under the condition that Non-GSO system shall not assign more than one channel in each frequency grid allocated for the existing system, it is unnecessary to consider the additional interference power level given by equation (24).

Among the above-mentioned parameters, (1), (2), (3), (4), (5) and (7) are required for the evaluation of interference probability when the existing system is in the communication mode, and (1), (2), (5), (6) and (7) are required for the evaluation of interference probability when the existing system is in the waiting mode.

9 Evaluation of interference probability

On the basis of presented in the above sections, the interference probability, P_i , for two potential interference paths from MES to Base station, and MES to LMS, both in the communications mode and in the waiting mode, are given by the following equations :

- (1) Existing MS system is in the communications mode:

$$P_i(\text{BaseStation}) = P_{bc} \times \eta_c \times \eta_L \times \eta_m \times \eta_D \times \eta_G \quad (25)$$

$$P_i(\text{LMS}) = P_{mc} \times \eta_c \times \eta_L \times \eta_m \times \eta_D \times \eta_G \quad (26)$$

- (2) Existing MS system is in the waiting mode:

$$P_i(\text{BaseStation}) = P_{bw} \times \eta_c \times \eta_L \times \eta_G \times \eta_W \quad (27)$$

$$P_i(\text{LMS}) = P_{mw} \times \eta_c \times \eta_L \times \eta_G \times \eta_W \quad (28)$$

10 Examples calculation results

On the basis of the proposed method, another Japanese contribution 8D/134, titled "Frequency Sharing Study Between Non-GSO MSS Earth-to-Space Links and the Land Mobile Service in the 148 - 149.9 MHz" presents the example calculation results by assuming actual values for the system parameters for Non-GSO MSS and MS systems.

11 Conclusions

This contribution proposed the generic method for evaluating interference probability from MES of Non-GSO MSS system to Base station, and to LMS of the existing MS system, when the MS system is either in the communications mode or in the waiting mode. From the reasons that the proposed method has a capability to evaluate the interference probability easily, and has a flexibility to apply any Non-GSO MSS systems in the FDMA operation, the employment of this method could facilitate the frequency sharing analysis between Non-GSO MSS system and the existing MS systems below 1 GHz.

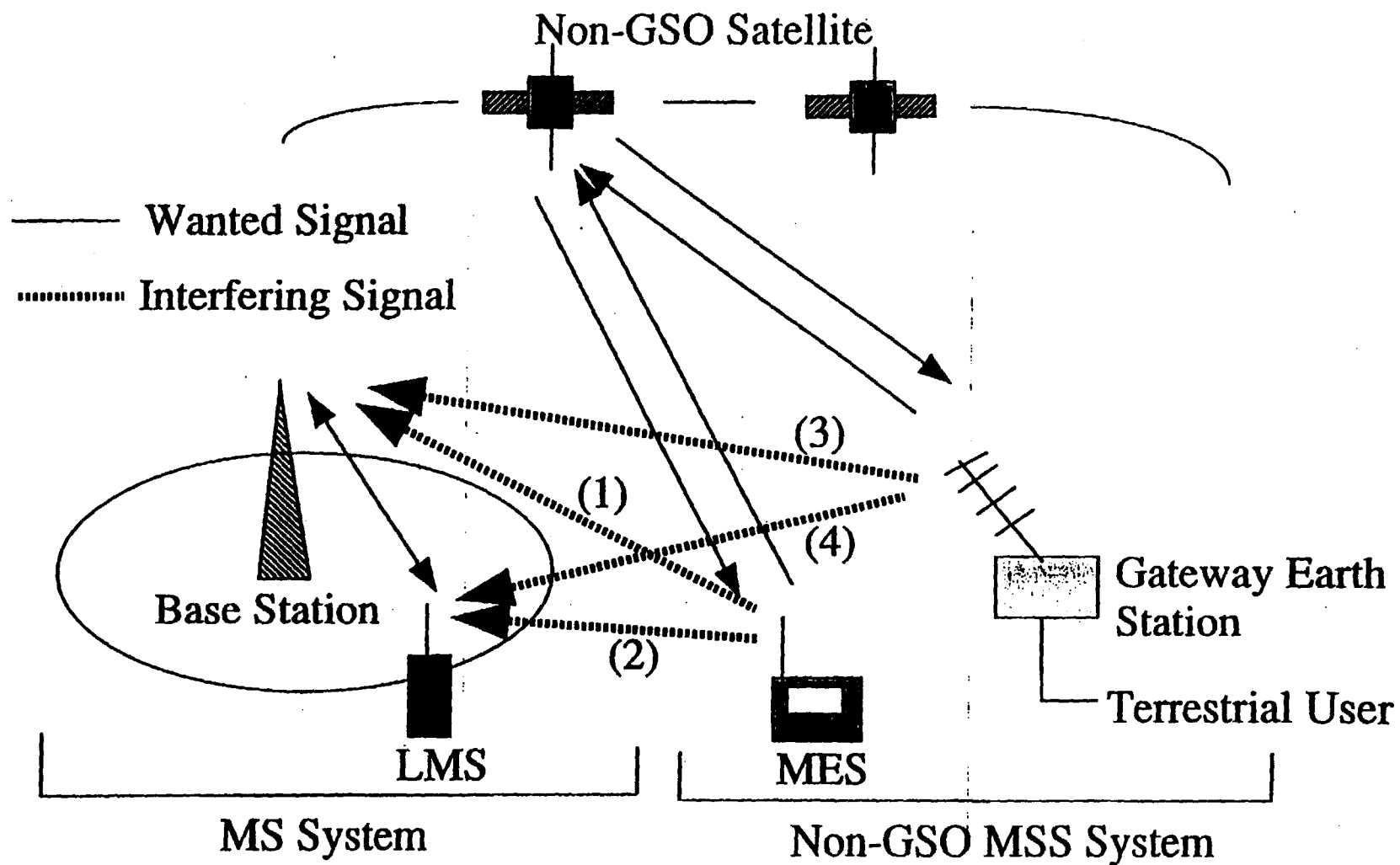


Fig.1 Interference Model between Non-GSO MSS and MS systems

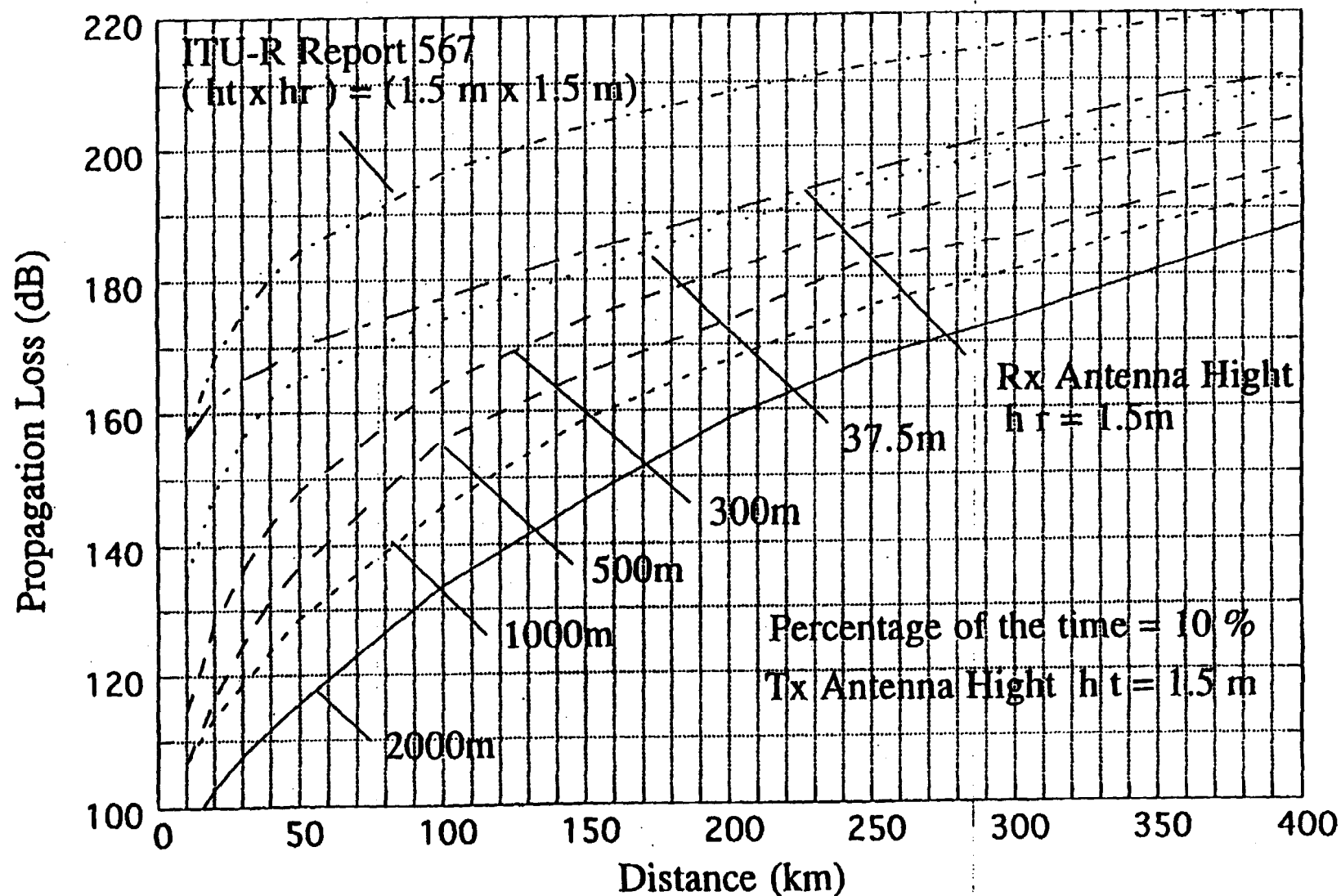


Fig. 2 Propagation Loss in the VHF Band (Based on ITU-R Rec. PN 370)

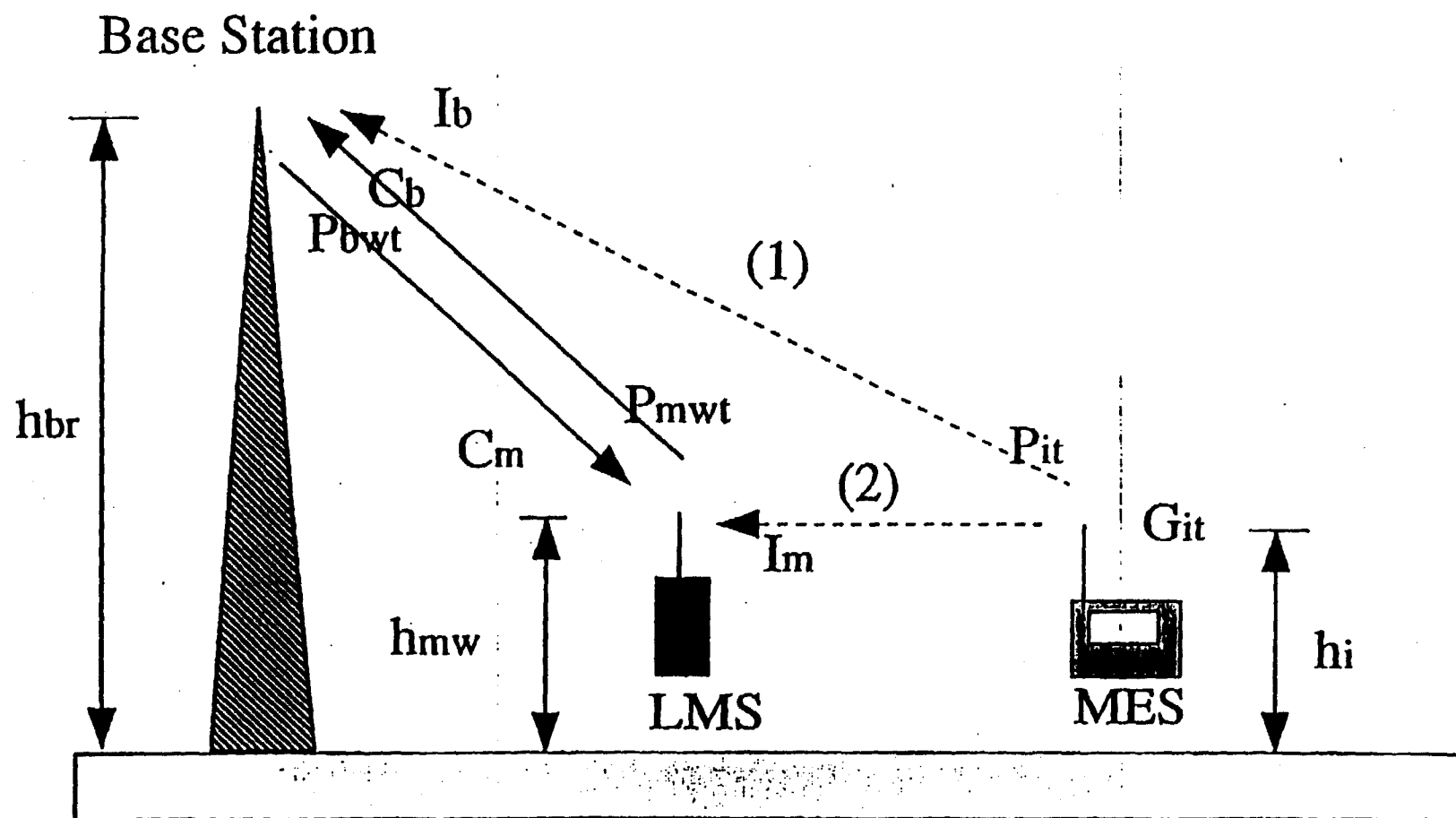


Fig. 3 Interference Model between MES and Existing MS System

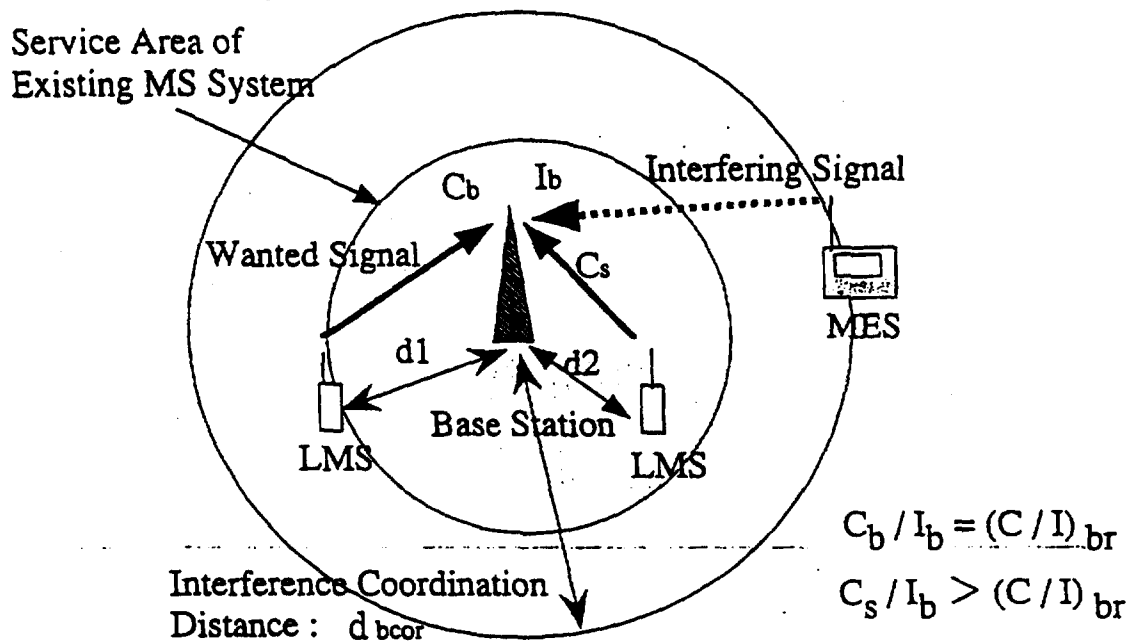


Fig. 4 Interference Coordination Distance for Base Station
in the Communications Mode

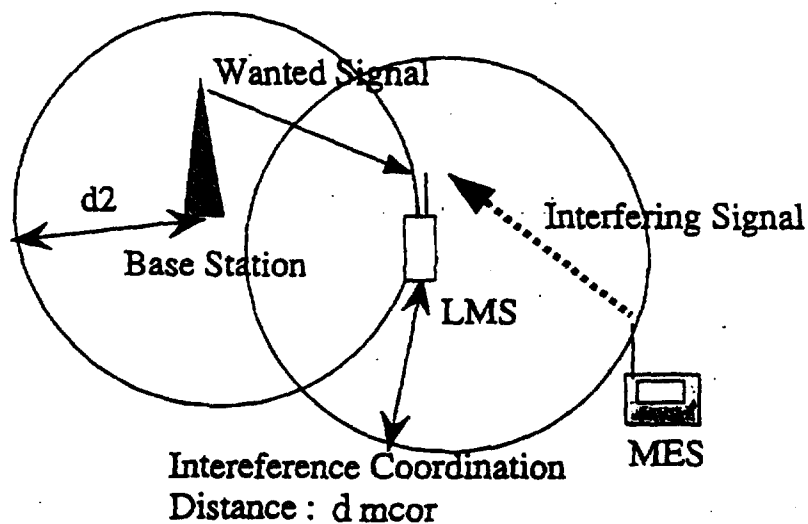


Fig. 5 Interference Coordination Distance for LMS
in the Communicatins Mode

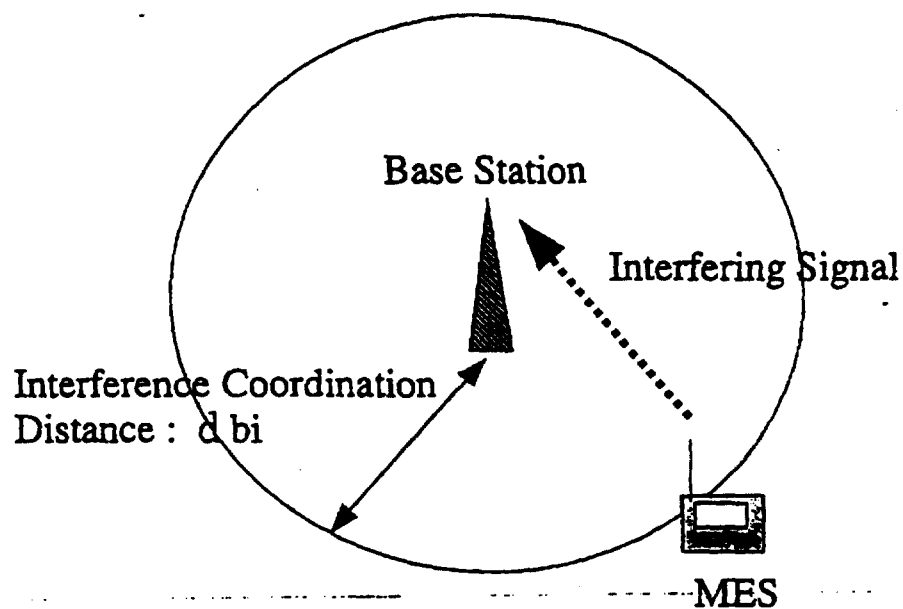


Fig. 6 Interference Coordination Distance for Base Station
in the Waiting Mode

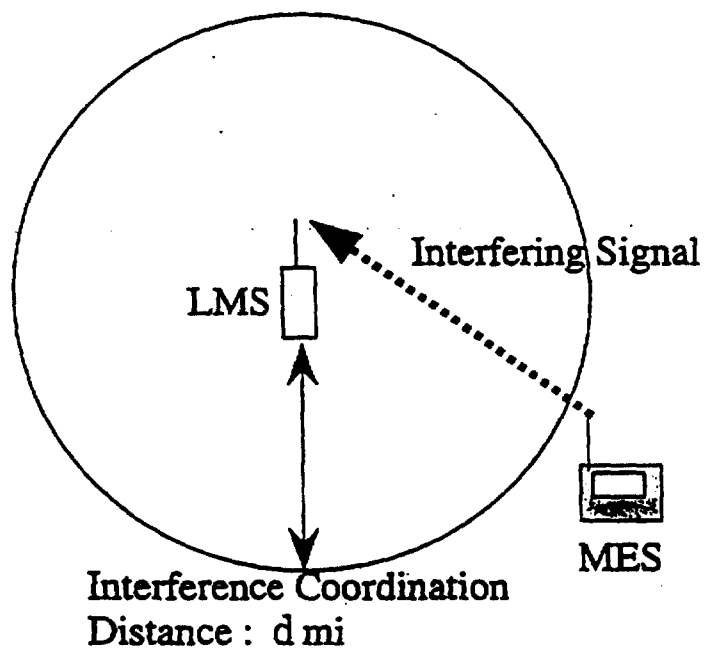


Fig. 7 Interference Coordination Distance for LMS
in the Waiting Mode

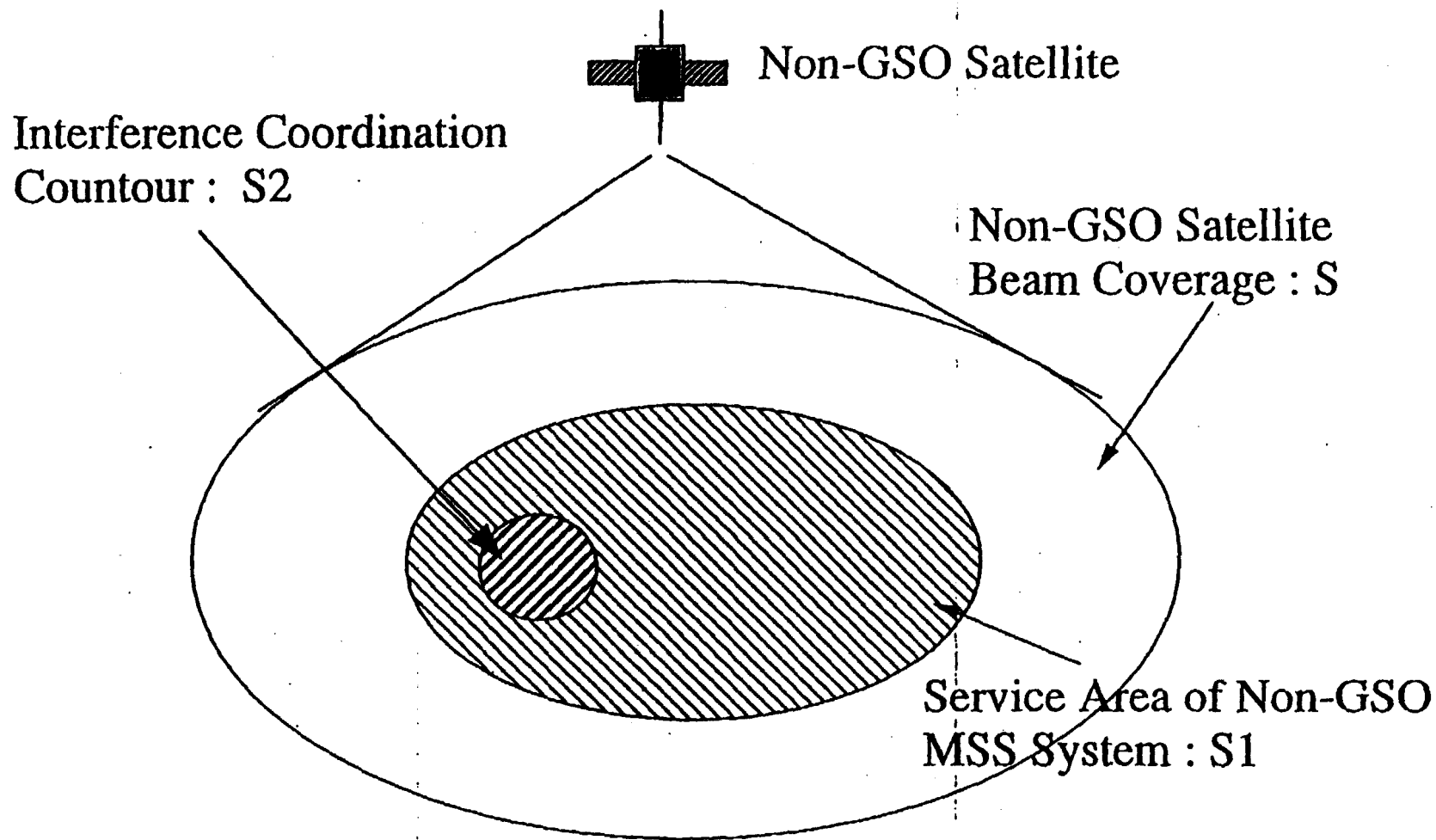


Fig. 8 Illustrative Drawing for Obtaining the Probability
that one MES is activated

APPENDIX

Improvement of Adjacent Channel Isolation with use of Interleaved Frequency Assignment

1 Computer simulation model

The following are the parameters for the MS carrier and Non-GSO MSS carrier used in the following computer simulation:

- (1) MS Carrier of Existing System (Interfered system)
(Analogue FM system)
Modulation : FM
Maximum Frequency Deviation : ± 5 kHz
Rx. Filter : Typical filter for FM used in VHF band
99% Power Containment Bandwidth : 16 kHz
- (2) MES carrier of Non-GSO MSS System (Interfering system)
Modulation : $\pi/2$ shift BPSK
Transmission Data Rate : 2.4 kbit/s
Tx Filter : Full Nyquist Filter with roll-off factor of 40%
Tx Amplifier type : Class- C amplifier
Maximum Doppler Frequency : ± 3.2 kHz

2 Computer simulation results

Using the simulation model illustrated in Fig. A-1, the adjacent channel isolation at the output of receiving filter for the MS carrier is evaluated with changing the Doppler frequency offset occurring in the Non-GSO MSS system due to the rotation of satellite. The maximum Doppler frequency offset for the Non-GSO MSS is assumed as ± 3.2 kHz.

Figs. A-7-1 and A-7-2 show the power spectrum obtained by the computer simulation and by the actual measurement both at the output of transmission amplifier, respectively. From these two figures, it can be concluded that the adjacent channel isolation obtained by the computer simulation is deemed appropriate.

Fig. A-8 shows the computer simulation result of the adjacent channel isolation level. From Fig. A-8, it is observed that the adjacent channel isolation Iso is 25 dB when the Doppler frequency for MES carrier is 0 Hz, and Iso is 2 dB when the Doppler frequency is the maximum of 3.2 kHz towards the existing system carrier. This worst case of 2 dB is used in the evaluation of interference probability from MES to the existing system with use of analogue FM carrier.

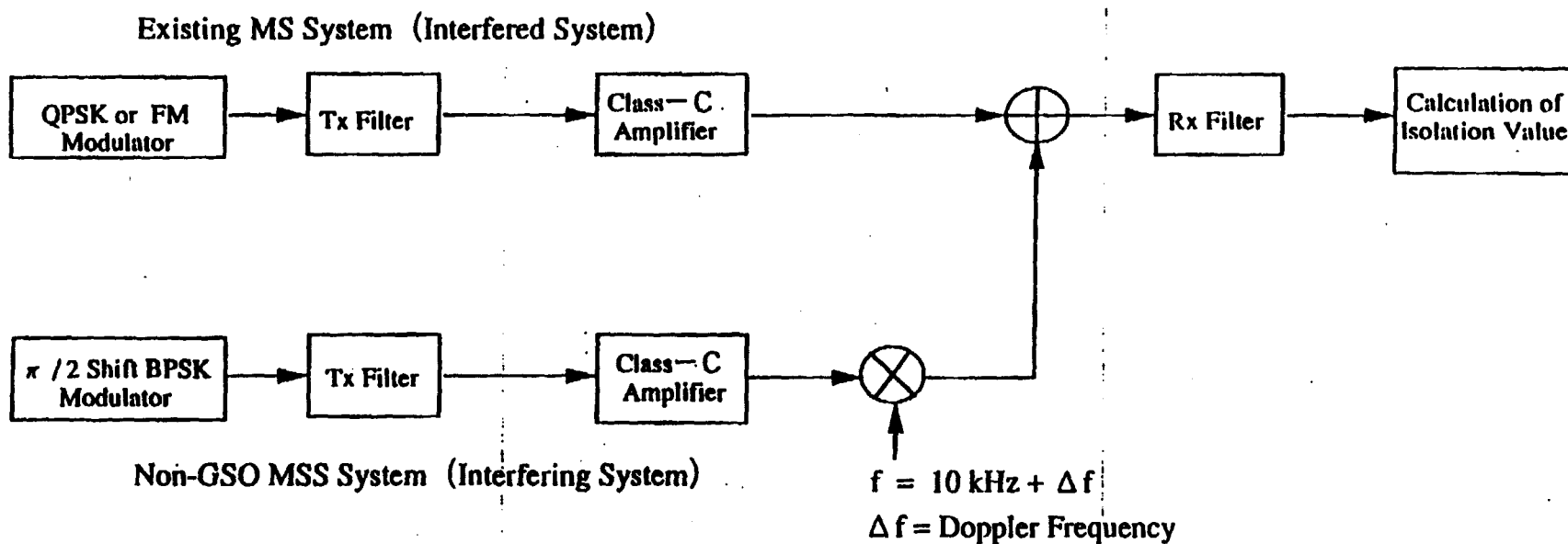


Fig. A - 1 Computer Simulation Model for the Evaluation of Adjacent Channel Isolation in the Interleaved Frequency Assignment

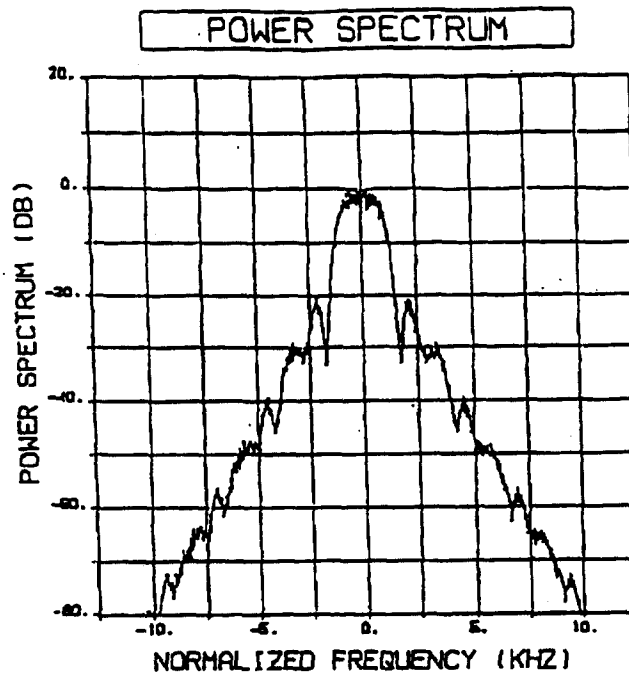


Fig. A - 7 - 1 Power Spectrum of MES Carrier obtained by Computer Simulation

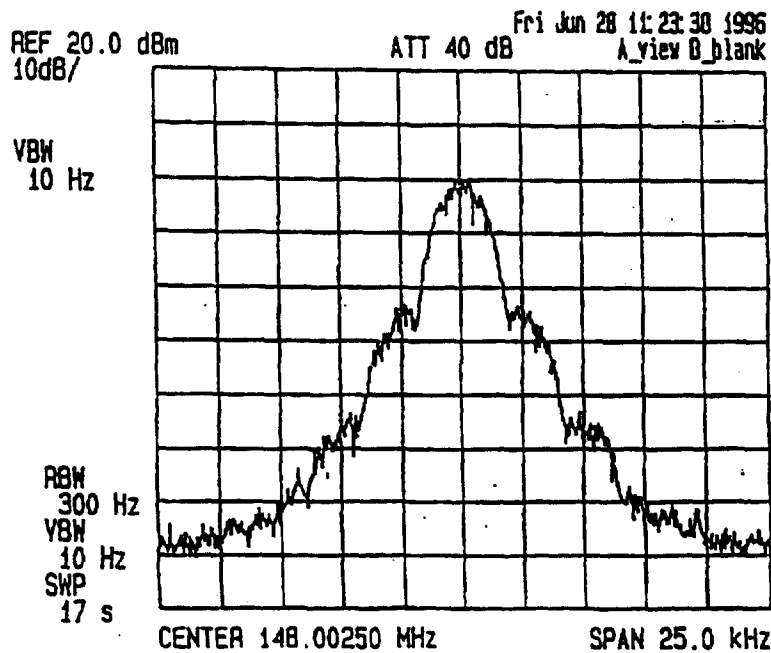


Fig. A - 7 - 2 Power Spectrum of MES Carrier obtained by Actual Measurement

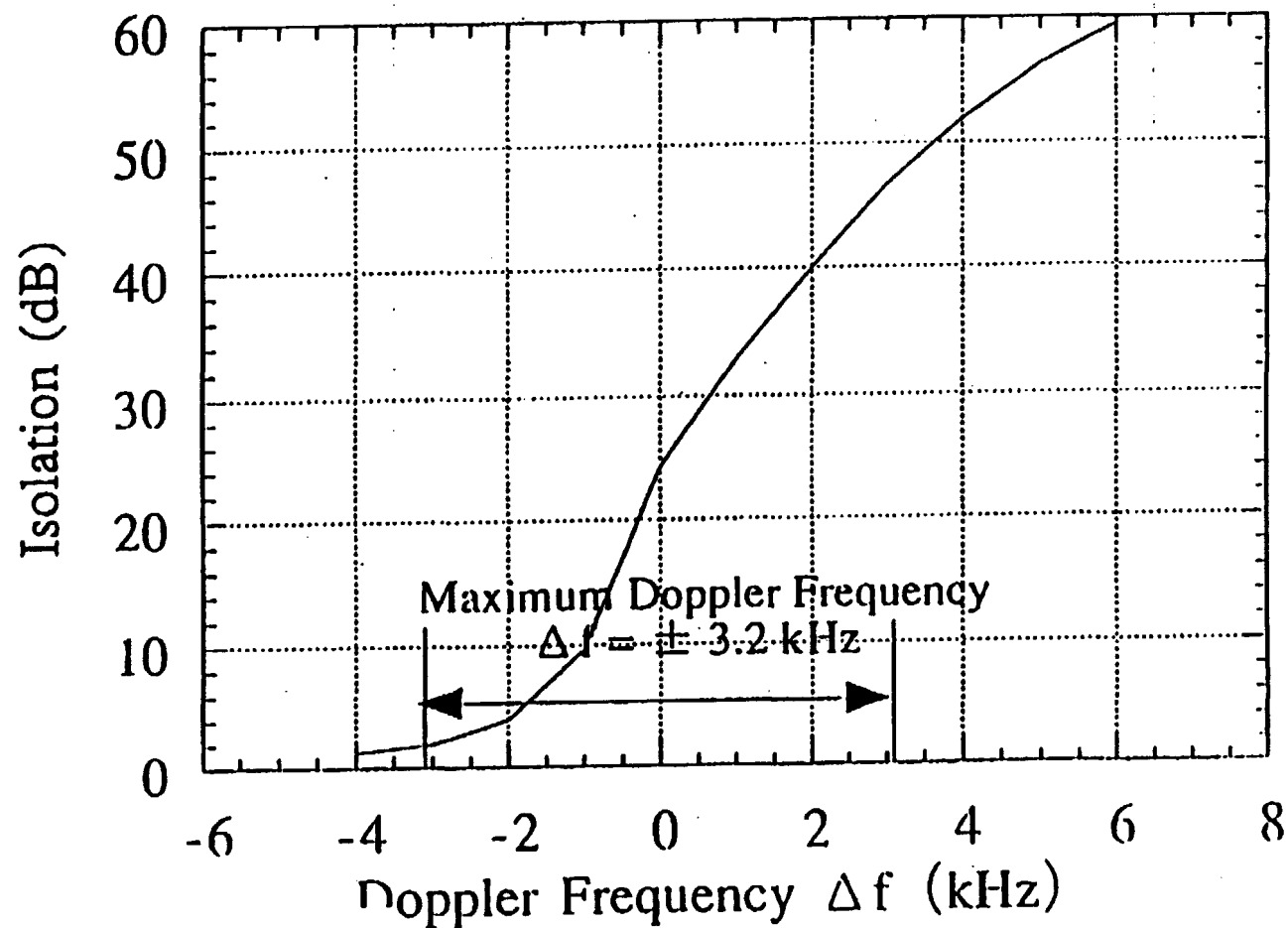


Fig. A - 8 Adjacent Channel Isolation vs Doppler Frequency (MS Carrier : FM)

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Reply Comments of Leo One USA Corporation was sent by first-class mail, postage prepaid, this 13th day of January, 1997, to each of the following:

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A handwritten signature in black ink, appearing to read "Fred L. Schuler", with a long horizontal line extending to the right.